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Hydrography Committee

# REPORT OF THE
# WORKING GROUP ON MARINE DATA MANAGEMENT
# BREST, 16-20 MAY 1983

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1. Opening of the Meeting

The Working Group met at the Centre Oceanologique de Bretagne (COB) with M.T. Jones (UK) in the chair. Members present were Y. Adam (Belgium), J. Blindheim (Norway), T. Dalzell (UK), P. Geerders (Netherlands), C.A. Goody (UK), D.R. Hamilton (USA), D. Kohnke (FRG), J.Y. Le Gall (France), M. Melguen (France), J. Raillard (France) and A. Svansson (Sweden). Other experts present were P. Alenius (Finland, representing P. Mälkki), M. Fevrier (France), N.C. Flemming (UK) and I. Svendsen (Norway, representing R. Leinebø). J. Churgin attended the meeting as observer for WDC-A and the Council was represented by its Hydrographer (J. Smed) and its Scientific analyst/programmer (J. Szaron).

In opening the meeting and welcoming the participants, the Chairman recalled the success of last year's 4 day mid term meeting. It had represented a great step forward from the one day meetings held in earlier years in connection with the ICES Statutory Meeting. This year a further step forward was being taken by meeting at one of the major national oceanographic data centres of the ICES community - the Chairman expressed his confidence that this would provide an additional stimulus to the Working Group's activities.

The Director of BNDO, Dr. Marthe Melguen welcomed the participants to Brest and stressed the value of seeing at first hand the activities of the various data centres. The meeting was pleased to accept her invitation to be shown around BNDO and its facilities on the Tuesday afternoon, and around the other parts of COB on the Thursday afternoon.

2. Composition of the Working Group

The addition of new members T. Aarup (Denmark), E. Buch (Denmark), B. Hansen (Faroe Islands/Denmark), M. Perttilä (Finland), G. Pestana (Portugal), J. Raillard (France), and J. Saarinen (Finland) was noted, as was the resignation of S. Lopes (Portugal), J.R. Wilson (Canada) and J. Szaron (Sweden). The Chairman expressed his concern about the loss of a potentially invaluable Canadian input to the activities of the Working Group. Good wishes were extended to J. Szaron on the start of his new career at the Service Hydrographique.

3. Adoption of the agenda

The Provisional Agenda was adopted as distributed with the addition of an item on the allocation of taxonomic codes (see cover page). It was agreed to give special consideration to 'The Management of classical hydrocast data' particularly in relation to the data banking activities of the Service Hydrographique. Suggestions for additional items on 'data inventory tools', 'the handling of satellite data - winds and waves' and 'the management of bathymetric data' were noted for possible inclusion in next year's agenda.

4. Report of the Hydrographer

4.1 Data management activities at the Service Hydrographique - a paper reviewing progress since last year's meeting was presented by the Hydrographer. He drew attention to the many activities of the Service including the production of charts, mean value tables and inventory lists, the servicing of requests to RNODC (Formats), and the routine processing and exchange of data. A considerable amount of data were punched and verified particularly from the CINECA region for use in the CINECA Atlas. The meeting noted with particular interest future plans for entering data through a terminal rather than via punched cards. Considerable interest was also expressed in the experiments carried out at the Service on computer produced charts of temperature and salinity for part of the Norwegian Sea; these charts were requested for studying the correlation between herring distribution and hydrographic conditions. Although it was recognised that computers could play a major role in the production of charts in future, it was agreed that a careful visual check on the plotted data would still be required.

The Hydrographer raised the question of the usefulness of the monthly charts of temperature and salinity. N.C. Flemming underlined their value to MIAS as a reference set, while P. Geerders stated that he had had many requests for these charts. The charts might also be useful in providing sea truth for satellite data. J. Churgin stressed the value of a long series of charts and J. Blindheim indicated that they might be useful in connection with studies of the mid-1970s anomalies. The meeting's attention was drawn to the activities of the newly formed Skagerrak/Kattegat Working Group, and it was agreed that their advice should be sought on the requirements for charts in the Skagerrak/ Kattegat area.

The Hydrographer reported that the editing and publication of the 1979 and 1980 ROSCOP forms had been completed and that the inventory for 1981 was now in preparation. He stressed the need for a revision of the ROSCOP form and it was agreed that the Chairman should compile a list of the problems encountered at the various data centres in the use of ROSCOP forms. It was also decided that this review should be forwarded to the IOC Working Committee on IODE and that the matter would be discussed further at next year's meeting of the Working Group.

At the request of the Chairman, the participants reported on the tape densities that their data centres could handle. A compilation is given in Annex E. Particular interest was expressed in a report by D. Kohnke of a successful transfer of data at 6250 b.p.i. between NODC, Washington and DOD, Hamburg - as far as participants could recall, this was the first occasion on which 6250 b.p.i. had been used for data exchange.

The Chairman also asked for information about the implementation of the Practical Salinity Scale introduced from January 1982. Although it was apparent that a number of laboratories were using the new scale, very little 1982 data had yet reached the data centres. It was agreed to keep this item under review.

4.2 JONSDAP '76 - The Hydrographer presented a draft version of the JONSDAP '76 Inventory. He commented on the difficulties encountered in obtaining the relevant information and in reconciling what was often conflicting information. The meeting commended him on the great deal of painstaking work that had undoubtedly gone into producing the Inventory, and looked forward to its final publication.

There was little further progress to report on the creation of the archive data sets for JONSDAP '76. Whereas much of the physical oceanographic data are available through MIAS and DOD, considerable pessimism was expressed about the practicality of producing an archive set for the biological data. It is understood that much of this data has not yet been submitted to the FLEX data centre and that little biological data exists in a form suitable for computer archival. The Chairman stressed that, once the Inventory was finalised, a review should be undertaken to identify the data that could be readily assimilated into the JONSDAP '76 archives.

In reviewing the experience of the JONSDAP '76 project, it was agreed that, for future experiments of this type, the preparation of a high quality inventory should be given the highest initial priority in the data management plan. An accurate inventory is of critical importance to the subsequent management and archival of the data. Furthermore, it is important to resolve queries on such items as date/time, position and depth at an early stage and to obtain timely information on data return. It was also recommended that data management experts should liaise closely with the scientists involved in the experiment once the data have been collected, and that the flow of data into the archives should be regularly monitored. The design of a 'user friendly' inventory form was another important aspect. D. Kohnke thought that the work involved in inventorying and banking data from an experiment was often underestimated. It was recognised that the JONSDAP '76 exercise was one of the first truly multi-disciplinary projects in the ICES area. At the time there had been virtually no previous routine exchanges of biological data, and many of the European data centres were at that stage still in their infancy.

4.3 North Atlantic Ocean Weather Stations

(Water Bottle data) - The Hydrographer reported on NAOWS data and inventories. Virtually all the water bottle data received by the Service Hydrographique were now on tape; a file for each Weather Station with the data arranged chronologically within each file. The data had been screened by the Service Hydrographique, and doubtful data had been discussed with the originator. M.T. Jones stated that all the missing UK water bottle data up to the end of 1979 had been acquired and screened by MIAS, and that an update tape was on its way to the Service Hydrographique containing 1400 additional casts. Except for OWS "Charlie" the Service would then have a virtually complete set of water bottle data for the OWS stations in the Eastern Atlantic. The Hydrographer was requested to acquire the outstanding data from OWS "Charlie"; the pre-1974 "Charlie" data would be available from the U.S.

(B T data) - T. Dalzell reported that the UK Hydrographic Department has a fairly comprehensive set of B T data from the NAOWS; the number of BTs held for each station being as follows:-

| | | | | | |
|---|---|---|---|---|---|
| A | 9,652 | B | 426 | C | 12,605 (up to 1972 only) |
| I | 13,006 | J | 15,481 | K | 6,665 |
| L | 3,974 | M | 9,209 | R | 3,593 |

An inventory of these holdings by station, year and month was handed to the Service Hydrographique. The Hydrographer agreed to check them against the numbers expected from the ICES NAOWS Inventory, and to report on the completeness of T. Dalzell's data bank. He was also requested to assist T. Dalzell in obtaining the post 1974 data for OWS "Charlie".

(Bibliography) - The planned bibliography of papers based, wholly or partly, on OWS data was discussed. It was agreed that the bibliography would be very relevant in the context of the World Climate Research Programme. T. Dalzell stated that the material was now with him and that a lot of work had already gone into it. However, he could give no firm commitment for completing it in the coming year as all the references had to be verified. M. Melguen volunteered to search the computerised bibliographic indexes accessible from BNDO - however, only 27 relevant titles were produced.

4.4 List of semi-permanent moored oceanographic stations - The Hydrographer presented the most recent list - the meeting felt that this service was useful and should be continued.

5. Progress Reports

5.1 Management of data on contaminant levels in fish and shellfish - The Chairman recalled the significant achievement of last year's meeting in drafting an Interim Format for the reporting of contaminant levels in fish and shellfish to the ICES Secretariat. This work was followed up through correspondence between the Environment Officer and the members of a small subgroup led by P. Geerders. Comments were solicited from the scientists in the ICES community who were actively involved in the collection of such data. The working version of the Interim Reporting Format was finalised during the Statutory Meeting by a small review group consisting of P. Geerders, M.T. Jones, J. Pawlak and J. Szaron. The Chairman stressed that the aim of the format was to act as a vehicle for gaining experience in the handling of contaminant data, and to assist the Environment Officer in the processing of the 1982 data. It would be premature to discuss the format further at this year's meeting, but a detailed review of experience to date and possible future developments of the format would be an important item on next year's agenda.

J. Szaron reported that he would start work on the computerisation of the Interim Format in June of this year in anticipation of all the 1982 data being received by August 1st. Processed output should then be available to the Environment Officer by October.

P. Geerders referred to discussions between ICES and the Joint Monitoring Group (JMG) of the Paris and Oslo Commissions concerning the handling of contaminant data and the usage of the ICES Interim Reporting Format. The meeting noted with interest the possibility that ICES might be asked to manage the JMG data. It was informed that the IOC/IODE Task Team on Pollution Data had expressed an interest in studying the Interim Reporting Format and that the format was also being studied by the IOC Secretariat for possible application to a contaminant monitoring programme in the Pacific region.

During the discussions, reference was made to the STORET system in use in the US for freshwater data and queries were raised about the applicability of the data formats within this system. However, it was stressed by J. Churgin that STORET was not a system for the exchange of data and D. Hamilton explained that it was an online storage and retrieval system allowing states and agencies to insert and process their own data. The main weakness of the system, from a data exchange point of view, was that users were encouraged to define their own parameters. Parameter standards were therefore limited, and there was some redundancy and inconsistencies between the various users.

5.2 Management of data from the Baltic Monitoring Programme - Some years ago, the Working Group had assisted in the development of a biological data reporting format for use in the Baltic Monitoring Programme. This programme is now well underway and the processing of the data is being carried out by the Institute of Marine Research, Helsinki. It was the understanding of the Working Group that copies of the hydrographic data (including the "classical" chemistry data) emanating from this programme would also be submitted to the ICES Service Hydrographique. As little data appears to have been submitted to date, the Hydrographer was asked to request these data from the Helsinki Commission's Secretariat.

5.3 Taxonomic Code Allocation - The meeting welcomed the increased interest being shown in the ICES community in the use of the NODC Taxonomic Code for the computerised storage of biological data, particularly in connection with the International Young Fish Survey data and data from the International Fish Stomach Analysis programme. However, some confusion appears to exist about the allocation of new codes.

It is recognised by the Working Group that the NODC Taxonomic Code was not intended to be a comprehensive code but that it was designed so that it could evolve according to user requirements. If the system is to have a good coverage of species in the ICES area of interest, it will be necessary for users to inform the US NODC as and when code allocations are required for missing species. The meeting agreed that it was of paramount importance to the orderly expansion of the code that all code allocations should be made only by the US NODC and that the generation of temporary codes within the system by users should be strongly discouraged. The meeting recalled the kind offer from the Director, US NODC in 1981 to provide an updating service to the Taxonomic Code for an initial experimental period up to the end of March 1983. The Chairman agreed to write to him with a request for a continuation of this service.

It was suggested from the ICES Office that the Office could assist by acting as a clearing house for code designation in the ICES area - this would to some degree be in line with its function as RNODC (Formats) for IODE. Requests could then be addressed to the Office where they would be coordinated and directed to the US NODC. C. Goody was not entirely happy with such an arrangement - his colleague Mr. Harding at Lowestoft was already in direct contact with US NODC and there was a case for encouraging a dialogue between those requiring codes and those allocating them. D. Hamilton stated that NODC would probably be able to give a certain priority to requests for code designation in relation to ICES coordinated projects. He estimated that some 100 codes were assigned each week and that the turnaround of requests for new codes was of the order of 3-4 weeks. As an interim measure it was agreed that where ICES users were liaising directly with NODC copies of their correspondence should be sent to the ICES Office for information.

5.4 Standards for the exchange of CTD and moored current meter data - The Chairman reported that the standards for the exchange of CTD and moored current meter data, developed by the Working Group meeting last year, had been well received by the ICES Hydrography Committee and by its Working Groups on Shelf Seas Hydrography and on Oceanic Hydrography. The CTD guidelines were also well received by members of SCOR Working Group 51 and are likely to be incorporated in their final report.

The meeting noted the need, expressed by the Shelf Seas Hydrography WG, for consideration to be given at some future date to extending the CTD guidelines to incorporate data from nephelometers, $O_2$-sensors and pH-sensors. The Oceanic Hydrography WG felt that some thought should be given to the classification of calibration data as a hydro-cast and logged in the data centres as such (see discussion under item 7a).

The meeting was particularly grateful to receive comments from C. Ross based on a review of the guidelines by a number of scientists at the Bedford Institute. Their main concern was that the documentation guideline was very complete and that very few people would bother to enter all the mentioned information. There was some sympathy for this point of view and for the suggestion that the guidelines should discern between useful and essential information. However, particularly in the case of the CTD guidelines which were specifically designed for the exchange of good quality, high resolution data, concern was expressed that the potential value of the data to the secondary user could be degraded by taking short cuts with its documentation. For the long term use of data, full documentation was a necessary requirement.

(C. Ross's suggestion that the guidelines should include a sample "coding" form has since been taken up by the IODE Group of Experts on Format Development - sample annotated listings will be included with the definition of the GF3 subsets).

J. Blindheim emphasised the need for standards in the processing of CTD data - it was pointed out that this was being discussed by SCOR WG 51 and that the ICES guidelines related specifically to the exchange of data once it had been processed.

5.5 ICES Current Meter Inventory - The Chairman reported on work being carried out by MIAS to extend its inventory of UK current meter data so as to include the data collected by other member countries of ICES. Preliminary files have already been set up inventorying data from Belgium, France, Netherlands, Norway, Portugal and Sweden. Sample listings were tabled and participants were canvassed for further contributions to the Inventory. The Chairman stated that MIAS intend to up-date each countries' entries once a year, at which time a comprehensive inventory would be compiled for distribution to centres participating in the scheme.

J. Raillard drew attention to the new Neptune system being developed at BNDO for inventorying not only moored current meter data but also a range of other types of oceanographic time series.

5.6 Brochure on data centre activities - P. Geerders presented an updated version of the brochure on Oceanographic Data Centres in the ICES Community. It was agreed that the brochure served a very useful purpose and P. Geerders was commended on his efforts. The meeting suggested that the brochure should be updated annually immediately prior to each meeting of the Working Group, and that future editions should also include information on the tape formats acceptable to the various data centres.

5.7 Intersessional activities of the IOC Working Committee on IODE - A report on the intersessional activities of the Working Committee was presented by its Chairman, Mr. D. Kohnke. He highlighted the recent activities of IODE in relation to the World Climate Programme and drew attention to the imminent publication of the RNODC Manual and of the GF-3 Introductory Guide. The meeting was informed that the Eleventh Session of the Working Committee will be held on 9-18 January 1984 in New York.

5.8 Long time series of ocean data - The CCCO at its Third Session invited the Service Hydrographique to collect and edit an annual review of time series of oceanographic measurements (TSOM). The Hydrographer reported that the Bureau of ICES had approved the Service taking on this task and that contributions to the first TSOM brochure were now coming in. He stressed that the brochure was intended as a collection of brief articles based upon data from various ongoing oceanographic time series, and not as an inventory of such series. However, he also reported that CCCO had compiled a data inventory but that its contents were incomplete, and in many ways its function overlapped that of the IOC Catalogue of Ocean Data Stations.

D. Kohnke recognised that there was a need for updating the IOC Catalogue and stated that this was under consideration. The Service Hydrographique had provided a major contribution to earlier editions of the Catalogue and the Service would have an important role to play in any future revision. It was agreed, however, that a clearer definition of requirements was needed, particularly in relation to climate studies, and that further involvement of the Service Hydrographique would be premature at this stage.

J. Churgin reported that WDC-A had received quite a number of requests for time series data. He informed the meeting that part of the WDC-A Data Catalogue was allocated to time series observations. Originally these were limited to coastal stations but now also included

oceanographic sections, although it was not complete. He stressed that when data from a section were submitted to WDC-A it should be indicated whether the section would be repeated. It was agreed that data centres should try to identify which incoming data are part of a time series, and to document them accordingly.

The Working Group expressed its willingness to look further into the problem of managing time series of oceanographic measurements, including sections. It was suggested that particular attention should be paid to time series of a duration of one or more years. However, the meeting felt that further information was needed on requirements from the user community. Input from the Hydrography Committee and its other Working Groups would be welcomed.

5.9 IOC General Format GF-3 - The Chairman reported on GF3 activities highlighting the preparation of the GF3 Introductory Guide; the development of GF3 subsets for specific types of data; and the development of portable software by MIAS to facilitate the reading and writing of GF3 tapes. He also reported that sample GF3 tapes had been distributed by MIAS to 20 laboratories/data centres for testing purposes, and that a number of centres were now able to read GF3 tapes.

(Postscript: The IOC Group of Experts on Format Development met on 6-10 June 1983 at IOS, Wormley, UK and finalised GF3 subsets for CTD, drifting buoy and moored current meter data. Details on these and other GF3 developments may be obtained from the Service Hydrographique in its role as RNODC (Formats)).

5.10 Exchange of aerospace remotely sensed data - P. Geerders reported, drawing attention to the activities of the IODE Task Team, and to the fact that the ICES Working Group on this subject had not yet been re-established. The IODE Task Team on the Exchange of RS data has concentrated on "awareness" - several organisations were contacted and were made familiar with the ideas of IODE. A special MEDI Catalogue on satellite data was being prepared, and entries had been received from USA, Norway, France, F.R. Germany and the UK. P. Geerders suggested that it might be useful if information were collated on the satellite data available for the ICES area, together with a list of addresses from which such data could be obtained. He agreed to draft, in close cooperation with the Hydrographer, a proposal for the next meeting concerning the possible role for the Service Hydrographique in this field.

6. Report from World Data Centres (Oceanography) and consideration of the revision of the 'Manual on International Oceanographic Data Exchange'.

The Director of WDC-A (Oceanography), Mr. J. Churgin reported on activities since the last meeting of the Working Group. During this period six magnetic tapes containing data from 212 cruises were submitted to WDC-A by the Service Hydrographique. He noted that of the 13,233 ROSCOP forms held by the centre, 86% had been contributed by the ICES member countries.

J. Churgin informed the meeting of the planned revision of the IOC manual on 'International Oceanographic Data Exchange' due to take place in 1984. A preliminary draft of the revised manual was tabled and participants were invited to comment. The meeting agreed that the section on which it could most usefully comment was that concerning the identification of those types of data that should be considered as standard in the data exchange system. A small group was set up to review this section - their draft proposal, as modified by subsequent discussion at the meeting, is contained in Annex F. It was suggested that useful additions to the manual would be a diagram illustrating the flow of data between the originator, NODC's, RNODC's and WDC's, and another showing the correlation between the various sub-paragraphs of the manual. A section should also be added defining in brief the role of the NODC's. It was also considered helpful to include a paragraph highlighting the need to take care about the problems of duplicate data - see draft in Annex C. Although data standards were not discussed in detail, attention was drawn to the relevance of the guidelines developed at last year's meeting of the Working Group covering the exchange of CTD and moored current meter data, and to the proposed revision of the 1969 ICES XBT Standard Criteria given in Annex D.

7. Special Topic : 'The management of classical hydrocast data'

The Chairman introduced the special topic by recalling the discussions associated with the 1982 meeting of the ad hoc group convened by the ICES President to consider the future role of the Service Hydrographique. That meeting had reaffirmed the continuing role of the Service as a regional data centre particularly for classical oceanographic data. It had also called for more emphasis to be placed on building up a comprehensive but selective data bank at the Service and for a more complete and timely submission of such data from the member countries. More active support was requested from the national data centres in assisting the Service in some of its routine tasks, particularly with respect to the pre-screening of data. It was recognised that the development of cooperation between the Service Hydrographique and the national oceanographic data centres (nodc) was one of the main tasks of the WG on Marine Data Management. The Chairman emphasised the relevance of the special topic to the present and future activities of the Service Hydrographique and it was agreed to give detailed consideration to the following items:-

a) CTD data at the Service Hydrographique
b) supply of hydrocast data to the Service Hydrographique
c) guidelines for screening water bottle data
d) review of formats for exchanging water bottle data
e) standards for the exchange of XBT data

A detailed questionnaire relevant to these items had been distributed by the Chairman in advance of the meeting and completed returns from 13 centres were available to the meeting for reference. To consider the various aspects of the special topic, the meeting adjourned into a number of small groups, each of which submitted draft reports for full discussion by all the participants.

7a) CTD data at the Service Hydrographique - The meeting recognised the need for incorporating good quality STD/CTD data into the archives of the Service Hydrographique for use with their water bottle data holdings; particularly as the flow of water bottle data into the data centres had fallen off during the past decade. Considerable discussion took place in attempting to reconcile the different resolutions and potential variations in accuracy between these two types of data.

Accuracy

Concern was expressed that the STD/CTD archives should not include uncalibrated data or data that had not been fully quality controlled by the originator. It was agreed that the Service Hydrographique should only bank STD/CTD data that was of a known and stated accuracy. It was thought useful to consider three distinct categories of hydrocast data in the Service's archives:

i) water bottle data.

ii) calibrated CTD/STD data of equivalent accuracy to that of a water bottle station - accuracies of $\pm$ 0.03°C in temperature and $\pm$ 0.04 in practical salinity or better were suggested (these limits will be reviewed by the Hydrography Committee)

iii) other CTD/STD data of a lower but known and stated accuracy.

For use in the generation of data products it was agreed that each category of data should be clearly identified e.g. by holding them in separate files.

Resolution

Guidelines had been developed at last year's meeting for the archival and exchange of high resolution (1-2 metre interval) CTD data. However, for secondary usage in conjunction with water bottle data there was a need to compress these data. It was agreed that the high resolution data should be maintained in the national archives and that only compressed versions should be submitted for archival at the Service Hydrographique. As a standard for compression the meeting felt that the criteria specified in the 1969 ICES STD Standard continued to be appropriate; i.e. to compress the record to

inflexion points such that linear interpolations will not deviate by more than $\pm$ 0.03°C and $\pm$ 0.04 practical salinity from the original record. It was agreed that the inclusion of observed values at the ICES Standard Depths (as given in the ICES punched card manual) would be a useful addition.

Rosette (multi) sampler data - The meeting considered a suggestion from the Chairman of the Oceanic Hydrography Working Group that some thought should be given to the classification of CTD calibration data (i.e. rosette or multi sampler data) as a hydrocast, and for them to be logged in the data centres as such. A number of reasons were quoted for this suggestion:-

i) more timely dissemination of at least some part of the data set

ii) more originators are now calibrating CTD's at many depths at each station (10-12)

iii) as a result of ii) there is a requirement for data centre archiving in any case

iv) it may encourage more originators to collect calibration samples much more frequently, thus increasing the reliability of CTD data for climatological purposes.

The suggestion gave rise to a lively discussion. It was generally agreed that where the sampler data had been integrated and reconciled with the CTD profile, it should be stored as supporting data/documentation to the combined CTD/sampler data series. Concern was expressed that if the sampler data was submitted to the Service Hydrographique independently of and in addition to the compressed version of the archived CTD file, this would lead to a duplication of data. On the other hand it was recognised that in certain circumstances there was a real need for submitting sampler data to the Service Hydrographique:-

i) if delays were anticipated in working up the CTD data or the sampler data was not reconciled with the CTD data

ii) where the water samples were subjected to further analyses e.g. for inorganic nutrients

iii) where the sampler data and CTD data were reconciled on a cruise basis rather than a station basis - in such cases the sampler data provided a useful additional source of data

On balance it was agreed therefore to encourage the submission of bottle sampler data to the Service Hydrographique, provided the potential overlap with subsequent compressed CTD data was clearly identified.

7b) Supply of hydrocast data to the Service Hydrographique - The Hydrographer presented a paper reviewing the supply of data to the Service. He recalled that for the period 1902-1962 hydrographic data (temperature, salinity, oxygen, nutrients) were routinely submitted by the ICES member countries, except for BT data. Data were published in the Bulletin for the years 1902-1956, and in ICES Oceanographic Data Lists for 1957-1962. During the early 1960's data volumes started to increase with the expansion of the research vessel fleets and the introduction of more automated data capture systems e.g. STDs and automated analysers. At about the same time the World Data Centres were established and a number of national oceanographic data centres were in the process of being set up, apparently making the banking of oceanographic data at ICES superfluous.

Under these circumstances ICES decided that it should no longer be an obligation for the member countries to send their oceanographic data to the Service Hydrographique. Member countries were however still expected to submit selected data needed for the various environmental summary charts being prepared by the Service. A certain amount of data continued to flow into the Service on a regular basis. Some countries continued to send their water bottle data for transfer from hard copy to punch cards, while others submitted their data on cards or magnetic tape.

The Hydrographer then reviewed the status of data submissions from the individual member countries, and participants provided information on further data available from their respective countries.

It was agreed that if the Service Hydrographique was to fulfil its functions effectively there was an urgent need for it to develop and maintain a comprehensive bank of good quality hydrocast data in the ICES area of interest. This could best be achieved if all member countries were to submit their data to the Service on a regular basis. The meeting then gave consideration to various aspects of the submission of data to the Service - details of which may be found in the proposed Recommendation (see Annex A).

Some concern was expressed about the duplication of data within historical files - this was related both to the problems of issuing corrections to data already archived and exchanged, and to the potential multiplicity of data paths into the Service Hydrographique and the World Data Centre system. The problem was further compounded by the duplication of data sets held in different centres for servicing secondary user requests. It was recognised that there was a need to clarify the mechanisms and procedures used for data exchange. The subsequent discussion led to the formulation of the guidance notes given in Annex C.

7c) Guidelines for screening water bottle data - Whereas a need will continue for the Service Hydrographique to carry out its own screening checks on the data it receives, the meeting agreed that this would be much less time consuming than at present, and would require much less correspondence if all data were first screened at a national level before submission to the Service. The participants at the meeting were keen to cooperate fully in this matter. It was recognised that there were obvious benefits to be gained if all national data centres were to carry out the same screening checks on their data. Although there were differences in detail in the way individual centres carried out this work at present, it was felt that there was enough in common between the methods to establish some general guidelines that might one day lead to a standard data screening procedure. On the basis of the information available on current practices for screening water bottle data the meeting was able to draft such guidelines (see Annex B).

It was stressed that if erroneous or suspect values were identified during the data screening process then it was the responsibility of the data centre to attempt to resolve such problems by reference back to the data originator. Concern was expressed that the data centres themselves should not attempt to modify or delete data - doubtful values should be flagged. D. Kohnke referred to the Skagerrak Expedition of 1966 where a number of instabilities were noted. It turned out that they were all located within the centre of the Skagerrak gyre and would seem to be real. Other examples of this type were quoted.

D. Hamilton explained how the existing water bottle data holdings of NODC were used to generate 5 degree square data envelopes of temperature, salinity and sigma-T for use in data screening. He stated that these envelopes were stored on computer disc and were available for exchange. At present the envelopes were based on data available up to 1976 and these were to be updated shortly to cover more recent data. Several participants expressed an interest in receiving copies of the updated envelopes.

7d) Review of formats for the exchange of water bottle data - At the present time, there are two recommended formats for the exchange of water bottle data in the ICES community - the ICES punch card system and the GF3 format. The meeting agreed that there was a need to review the ICES punch card system and, at the same time, to take further steps with the development of a suitable standard subset of GF3 tailored specifically to water bottle data. It was envisaged that, providing a GF3 subset could be designed in a form readily adaptable for inhouse data banking use, the ICES punch card system might one day be replaced by GF3. However, it was stressed that for the forseeable future the ICES punch card system should exist in parallel with GF3 for exchange purposes.

It was recalled that the ICES punch card system had been designed originally in the era of card sorting machines rather than for modern computers. Nevertheless, it had served the ICES community well over a long period of time and it was still in active use. However, it was agreed that some of its features, particularly the overpunches and the lack of precision in certain fields, appeared outdated and were in need of revision. It was further agreed that, rather than attempt to redesign the system, it would be more profitable to undertake a full review of the punch card format and to incorporate these findings in the design of an appropriate GF3 subset.

During the meeting a provisional draft was prepared identifying those fields in the ICES punch card system that were in need of review. Considerable discussion ensued following a proposal to remove the surface meteorological data from the system. Some members considered it useful to have these data included - for example in the Baltic there is a close relationship between the meteorological and hydrographic conditions. It was pointed out that the near surface water properties are linked to past meteorological conditions rather than those prevailing at the time of a water bottle station. A review of experiences in the data centres represented at the meeting provided a fairly strong case against the inclusion of meteorological data in the system. In general the meteorological data stored in the water bottle files were of a low quality and were often subject to transcription errors. The screening of the meteorological data often took a disproportionate amount of time and, on occasions, delayed the input of good quality water bottle data into the international exchange system. Furthermore, it was a common experience amongst the data centres that the meteorological data in the water bottle files were very rarely requested by secondary users. For those with a real interest in relating the hydrographic and meteorological conditions it was suggested that properly constituted meteorological files were required - occasional spot values at the time of the water bottle stations were considered a poor substitute. It was agreed that comments should be solicited from the Working Groups on Oceanic and Shelf Seas Hydrography on this matter.

In order to continue the development of a GF3 subset tailored to water bottle data, the Chairman agreed to work by correspondence with members during the intersessional period. He also agreed to report the Working Group's discussions to the forthcoming meeting of the IODE Group of Experts on Format Development, Wormley, 7-10 June 1983. (Postscript: The Wormley meeting, in recognising the lead role being taken by the ICES Working Group in the development of an appropriate GF3 subset for water bottle data, invited the Working Group Chairman to liaise closely with the members of the Group of Experts and to keep them informed on progress).

7e) Standards for the exchange of XBT data - At the request of the Director of WDC-A (Oceanography) the meeting was asked to advise on XBT standards for inclusion in the revised edition of the IOC Manual on International Oceanographic Data Exchange. On the basis of current practices for the digitisation of XBT data in the various data centres, the meeting felt there was a need for bringing the 1969 ICES XBT Standard Criteria up to date, and a revised standard was proposed as given in Annex D.

In response to a question from J. Churgin concerning standards for evaluating XBT data, T. Dalzell stated that in some institutions a quite complex procedure was used. It was stressed that an evaluation should be undertaken before digitisation, and a number of participants reported on the evaluation methods and quality tests used in their centres. At the request of the Chairman, T. Dalzell agreed to review the screening methods currently in use at the major centres and to draw up some guidelines for next year's meeting.

There was some discussion as to whether XBT data of less quality than the standard should be exchanged. It was recognised that such data might have specific but limited use. However, it was agreed that where data had been digitised to a lower standard they should not be used for generating vertical profiles and they should be clearly identified with appropriate labels.

8. Next Meeting

For its next meeting, the Working Group would welcome a report from the Environment Officer and the Scientific Analyst (J. Szaron), on their experiences in handling the 1982 data returns on contaminant levels. It would also find useful an overview from the Environment Officer of the work undertaken and planned by the coordination groups, particularly in relation to contaminant data.

Two main items were suggested by the Chairman for consideration as special topics at next year's meeting:-

i) A review of progress on the development of taxonomic codes and on the management of data on contaminant levels in fish and shellfish.

ii) The future development of data inventories (e.g. ROSCOP and 2nd level inventories).

Some other items may well arise from the Statutory Meeting. A continuing item would be data management at the Service Hydrographique and cooperation with the national data centres.

It was agreed to recommend that the next meeting of the Working Group be held for 4 days at ICES Headquarters with the above main subject areas - the dates of 15-18 May 1984 were tentatively suggested. The Council's Hydrographer and Environment Officer should attend together with the Scientific Analyst of the Service Hydrographique.

9. Any other business - None

The Chairman drew attention to the fact that it would probably be the last meeting of the Working Group at which Mr. Smed would attend as the Hydrographer of ICES, and expressed the hope that he would be present at next year's meeting. He paid tribute to Mr. Smed's outstanding service over a great number of years, both to the Service Hydrographique and to the cause of international oceanographic data exchange. The high standards and dedication so obviously apparent in all his work would continue to serve as a shining example to everyone.

In closing the meeting the Chairman thanked those present for their hard work. He thanked the Director of COB and his staff for making the Working Group feel so welcome and for making such excellent facilities available. Particular appreciation was expressed to BNDO, its Director and staff, for hosting the meeting, and for demonstrating their work. The hospitality the Working Group had received would long be remembered.

The meeting was formally closed at 1900 on Thursday 19 May. On the Friday morning the participants attended a number of demonstrations on the processing of images from satellites and other data sources at COB.

Meirion T. Jones
Chairman

ANNEX A

RECOMMENDATION FOR SUBMISSION OF DATA TO THE SERVICE HYDROGRAPHIQUE

In order that the data bank of the Service Hydrographique may fulfil its aims as a source of data for, e.g.

i) preparation of standard environmental data products;

ii) studies of climatic changes and regional variations in the hydrography of the ICES area of interest;

iii) researchers in the ICES community

it is recommended that the following types of data, collected in the ICES area of interest, be routinely submitted to the Service Hydrographique for inclusion in the hydrographic data bank:

a) Water bottle data (incl. Rosette sampler data): temperature, salinity and all other parameters contained in ICES Hydro Chemistry Card 56;

b)* Calibrated CTD data with absolute accuracy of $\pm$ 0.03°C in temperature and $\pm$ 0.04 in practical salinity, or better; (limits to be reviewed by Hydrography Committee)

c)* other CTD/STD data of lower but known and stated accuracy;

d) combined values of surface temperature and salinity.

The following should be observed in submitting data to the Service Hydrographique:

1. Data should preferably be submitted either in GF-3 or in the ICES Punch Card Format;

2. The flow of data should preferably be coordinated through a single focal point in each country (e.g. the national oceanographic data centre);

3. Prior to submission, the data should be screened at the national level (e.g. by the national oceanographic data centre);

4. Data should be submitted in a cruise ordered basis so as
   i) to ensure that oceanic cross sections are maintained intact,
   ii) to facilitate data screening and checking for duplicate data,
   iii) to facilitate replacement of data by improved versions;

5. Data should preferably be submitted within eighteen months of their collection.

Footnote

*Additional parameters that may be measured with the CTD/STD, with a known and stated accuracy, e.g. oxygen, should also be included. Prior to submission CTD/STD profiles should be compressed to inflexion points such that linear interpolations will not deviate more than $\pm$ 0.03°C and $\pm$ 0.04 practical salinity units from the original/processed record (as in the 1969 ICES Standard). They could also include the observed values at the ICES standard depths (as in the ICES Punch Card Manual).

ANNEX B

GENERAL GUIDELINES FOR SCREENING HYDROCAST BOTTLE DATA

These notes are presented to data centres in the ICES community in order to stimulate the establishment of agreed-upon screening methods for hydrocast bottle data. It is anticipated that, by passing data through common screening procedures before they are submitted to the Service Hydrographique, the effort required at the Service to prepare data for loading onto its data bank will be greatly reduced. Such uniformity in screening should also increase the value of the data to the end user.

General guidelines - It is strongly recommended that data values should not be automatically deleted, corrected or flagged by computer alone. Whereas computers have an invaluable role to play in identifying potentially suspect data, questionable values should always be reviewed by knowledgeable personnel before deletions or corrections are made or quality flags are added. Whenever possible, data centres should flag data values rather than delete or correct them - deletions or corrections should normally only be made in collaboration with the data originator. For flagging purposes, the GF3 data quality flag system is strongly recommended viz:

| Code | Descriptor |
|---|---|
| blank | Unspecified or quality control check has not been made |
| A | Acceptable : data found acceptable during quality control checks |
| S | Suspect Value : data considered suspect by the data originator on the basis of either quality control checks or recorder/instrument/platform performance |
| Q | Questionable Value : data considered suspect during quality control checks by persons other than those responsible for its original collection e.g. a data centre |

N.B. Where data is flagged as suspect without recourse to the data originator, the 'Q' flag should always be used rather than the 'S' flag.

When data is submitted from a national level (e.g. from the national oceanographic data centre) to a regional (e.g. ICES) or World (e.g. WDC) data centre for archival purposes, it is recommended that it be accompanied by a statement of the screening procedures that have been carried out on it.

Cruise level checks - In order to screen data properly it is essential to have sufficient documentation about the cruise on which the data was collected. This requirement may be met by a completed ROSCOP form or other data documentation forms. It is important to check that the position, date/time and identifier information in each station header is consistent within the cruise.

Thus:

*ship, institution, country should be the same throughout the cruise

*station numbers should be in the correct sequence

*dates and positions should be reasonable and match the cruise documentation

*date/time should increase throughout the cruise

*station positions must not be on dry land!

*a good test of both positions and dates is the computed ship speed between stations

*a plot of the cruise track from the station header data is an excellent tool for checking cruise level logic of positions

Other types of data plots can be made, either by machine or manually, to aid in cruise-continuity evaluation of each station. For example, all depth profiles of one parameter from the cruise can be plotted in sequence or superimposed. In addition, various statistical analyses can be made.

Station level checks -

*each station should include sufficient data to constitute a station; at least one subsurface measurement is required

*header and data records must be properly constructed and formatted. No illegal or extraneous characters should be present e.g. alphabetic characters must not appear in numeric fields. Where coded, field entries should conform to entries in the relevant code table. Default or null values should be entered correctly

*tests for conflicting data fields e.g.

  *sea floor depth is in accord with the station's geographic position

  *check depth of deepest observation against sea floor depth (note that unresolvable slight conflicts may arise occasionally from different methods of measurement e.g. thermometric bottle depths compared with echo sounder depths)

*data records must include at least one measured parameter and depths should increase from one data record to the next

Data plausibility checks -

*In order to detect gross errors, brought about for example by the faulty transcription of data from coding forms, measured values can be compared to absolute minimum and maximum bounds. For some of the more commonly measured parameters the following limits may prove useful for a first order computerised check on the data:

| Parameter | Units | Limits |
|---|---|---|
| temperature | $^{o}C$ | -2.5 to +35 |
| salinity | - | 0 to 40 |
| oxygen | ml/l | 0 to 14 |
| phosphate | $\mu$g-at/l | 0 to 4 |
| nitrite | $\mu$g-at/l | 0 to 4 |
| nitrate | $\mu$g-at/l | 0 to 44 |
| silicate | $\mu$g-at/l | 0 to 300 |
| pH | - | 7.4 to 8.5 |

It must be stressed that the above limits are for guidance only - due to local conditions the upper bounds may have to be increased in certain cases.

*Instability checks provide an invaluable check on temperature and salinity values. Thus if the instability in $\sigma_t$ is greater than 0.02 the data should be pulled out for further examination.

*It is recommended that data be compared to known general oceanic conditions, as determined by historical surveys in the same region as the data. However, this information must also be used in conjunction with known anomalies at the time the survey was made. Such screening can be accomplished by manual comparisons to atlases or historical data summaries. It is also possible to compare data automatically to regional water mass summaries or models, producing computerised messages which call attention to suspect data.

*It is also recommended that each station be compared to other stations on the cruise

*Vertical profile plots of each parameter at each station will be found useful in providing a quick visual check on data values, particularly on vertical continuity. Automatic rate of change with depth checks may also be found useful in identifying suspect data.

*<u>cautionary note</u> - the above data plausibility checks should be used solely as a means for identifying potentially suspect data requiring closer examination. They should not be used as the basis for deleting or correcting data - this should only be done in conjunction with the data originator, or by reference to additional source material such as log books or coding forms.

ANNEX C

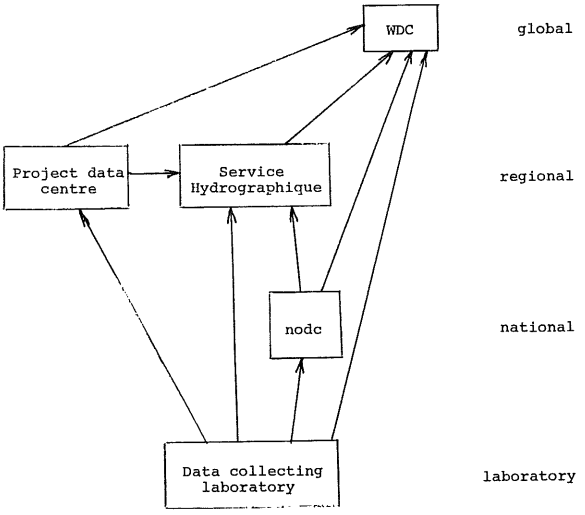
THE DUPLICATION OF OCEANOGRAPHIC DATA - SOME NOTES FOR GUIDANCE

Concern has been expressed over the dangers resulting from duplication of data sets held in different centres, and the consequent risk of duplicate data values being recorded in merged or combined data sets. Duplicate data sets can also become out of date in relation to the data held by the originator or the primary data centre.

The risks of corruption of data arising from duplication occur both during the phase of transferring data from the originator in to NODCs, RNODCs and WDC; and during the subsequent phase of transfer of data from WDC to NODC to end user. The two directions of transfer will be discussed separately; the inwards transfer towards WDC will be discussed first.

DATA ARCHIVAL - THE INPUT ROUTE (PRIMARY ARCHIVES)

There are many possible routes along which data may pass through into the World Data Centre system - this is illustrated below:



Data originators, especially during and after international projects, may exchange data amongst themselves, with the project data centre, and with NODC's. Subsequent transfer of data between NODCs, or of up-dated data to one NODC, may lead to undetected duplicate values in a data archive. Further transfer of data from NODC level to WDC or RNODC level can perpetuate or compound the duplication, and make it even more difficult to detect. This is complicated if errors are either corrected or introduced during the transfer leading to different versions of the same data series. It is difficult to detect duplicate data values if corrections or code conversions have been applied by one data holder and not another.

To avoid the problems of data duplication, the following guidelines are suggested:-

1. For the long term storage of data three primary archives are recognised - the WDC at the global level, the regional data centre (i.e. the Service Hydrographique) and a centre at the national level (i.e. in the country from which the data originates). It is important that each of these primary archiving centres holds one (and only one) and the same version of each data series, and that there should be a direct and regular communication between these centres so as to ensure this. In particular, each of the centres involved in primary archival should be kept clearly informed of relevant data exchanges between the other two primary centres.

2. Whenever practical, the flow of data should be coordinated at a national level through a single focal point (usually the nodc or its equivalent), which is kept informed of data submissions to the regional and world data centres.

3. Whenever practical, the data should be fully screened by the nodc (or its equivalent), in conjunction with the data originator, before it is submitted for international exchange - the aim being to remove errors at source.

4. If errors are detected at the regional or world level, they should be reported back to the national level, to give the nodc (or its equivalent) the opportunity to create a revised version in conjunction with the data originator.

5. If the regional or world data centre receives data from a source other than the nodc (or its equivalent) of the country in which it originated, that nodc should be informed.

6. Each of the primary archiving centres are urged to identify and remove duplicates and errors in their archives, and to inform the other primary archiving centres accordingly, particularly if revised versions of the data are created.

7. Alterations, corrections, or up-dates to data which have already been submitted to the regional or world data centres should be brought to the attention of the recipients; where large numbers of alternations are required, it is preferable that a complete corrected data set be submitted rather than a list of individual corrections - in this case the recipient must be clearly informed that the data is to replace existing data.

8. The control and identification of duplicate data is greatly simplified if the data is submitted to the primary archiving centres in cruise ordered form. Information about the cruise (such as reference number, cruise/leg number, name of project, duration of cruise, chief scientist, etc....) should be submitted along with the data so as to maintain a better identification of the data.

9. Geo-sorted and other merged or composite data sets submitted for archival should be supplied with internal header information stating the cruise or other identifiers of the sub-sets and sources of data; if this cannot be done a general header should state that the data set is composite, and give information about the sources.

10. Data should not be loaded onto the primary archives until careful checks have been made to ensure that the process will not result in duplicate values.

DATA ARCHIVAL - THE OUTPUT ROUTE (SECONDARY ARCHIVES)

The following considerations apply to the transfer of data from the WDC to NODCs and to secondary and end user.

Where a data centre has acquired a data set from the WDC system, other NODC's or RNODC's on behalf of an enquirer, the data centre may wish to retain the data as a provision against future enquiries, or because they have a continuing interest in a specific sea area. In such cases the data centre should be aware that the original data set may be up-dated from time to time, or errors may have been deleted, by the originating data centre. Where duplicate data sets are deliberately held in this way the holder should make regular contact with the originating centre to check whether the old data set is still valid, whether it should be deleted, or whether new data are available. Care should be given to the avoidance of false data entries arising from duplication of original and revised data values, appearing as separate data values.

Secondary users detecting errors or duplicates in a data set acquired from the WDC system are urged to report their findings back to WDC or the supplying data centre.

ANNEX D

XBT ICES STANDARD CRITERIA

1969 ICES XBT Standard Criteria

XBT data for exchange should be expressed in digital form either at 3m intervals to an accuracy of 0.2°C for the entire depth of the trace or at "flexure" points determined in such a way that linear interpolations fall within 0.2°C of the original record.

Proposed 1983 ICES XBT Standard Criteria

(To replace the above)

1. XBT data should be critically evaluated before exchange;

2. Accepted observations should be digitized at inflexion points to a resolution of 0.1°C in temperature and 2m in depth;

3. Observations digitized at fixed intervals may also be exchanged if linear interpolation between digitized points, falls within 0.2°C of the original profile;

4. Data digitized to standards other than the above, should be clearly identified as special data sets that may not be suitable for regenerating vertical structure.

ANNEX E

TAPE DENSITIES (b.p.i.) THAT CAN BE HANDLED BY THE VARIOUS DATA CENTRES

As per May 1983

| | | |
|---|---|---|
| MAFF, Lowestoft | : | 800, 1600 |
| BNDO, Brest | : | 800, 1600, 6250 |
| IHR, Göteborg | : | 800, 1600 |
| IMR, Helsinki | : | 800 |
| NCOD, de Bilt | : | 800, 1600, 6250 |
| UGMM, Leige | : | 1600, 6250 |
| NOD, Bergen | : | 1600, 6250 (800 with difficulty) |
| NODC, Washington | : | 800, 1600, 6250 |
| MIAS Bidston | : | 556, 800, 1600, 6250 |
| DOD, Hamburg | : | 800, 1600, 6250 |
| U.K. Hydr. Dept. | : | 1600 (556, 800) |
| Service Hydrographique | : | 1600, 6250 (800 with difficulty) |

ANNEX F

PROPOSALS FOR CONSIDERATION IN UPDATING THE IODE MANUAL
ON INTERNATIONAL OCEANOGRAPHIC DATA EXCHANGE

(note that paragraph and section numbers refer to those in the current edition (fourth) of the manual)

I Add a flow diagram illustrating the typical flow of data between originator, NODC's, RNODC's, and WDC's.

II Paragraph 2.3.1 Add section defining in brief the role of the NODC's.

III Add a diagram showing the correlation between sub-paragraphs of Sections 4, 5, and 6.

IV Paragraph 3.4 renumber existing paragraph 3.4 as 3.4.1 and add:

3.4.2 Where a data centre has acquired a data set from the WDC system, other NODC's, Regional Oceanographic Data Centres or RNODC's on behalf of an enquirer, the data centre may wish to retain the data as a provision against future enquiries, or because they have a continuing interest in a specific sea area. In such cases the data centre should be aware that the original data set may be up-dated from time to time, or errors may have been deleted, by the originating data centre. Where duplicate data sets are deliberately held in this way the holder should make regular contact with the originating centre to check whether the old data set is still valid, whether it should be deleted, or whether new data are available. Care should be given to the avoidance of false data entries arising from duplication of original and revised data values, appearing as separate data values.

V The proposed redraft of Section 4 identifying standard data types suitable for widespread exchange is given below in full so as to give members of the ICES community the opportunity to comment:

4. TYPES OF OBSERVATIONS AND DESCRIPTION OF DATA

Data types are classified as standard and non-standard. Standard data are handled routinely by the international oceanographic data exchange system. Non-standard data types include those which are experimental, or where data volumes are very great, or where techniques of data reduction are still not agreed. It is recognised that some data types which are at present non-standard will become standard in the course of a few years. Data types listed in section 4.2 are those which are likely to be used during experimental work, and may be exchanged at national level, or in the course of special international projects. When non-standard data types evolve and are established as standard data, these changes may be notified by IOC as addenda to this manual.

4.1 Standard observations

These are environmental observations or measurements made from oceanographic ships, other mobile platforms, shore or fixed stations with generally accepted types of instruments and methods widely known and described in the scientific literature. Data of this classification, when submitted for general use, either require no further correction, or the corrections are well known and generally available. Data resulting from these observations or measurements should be exchanged through the World Data Centres or other permanent centres (see Sections 1 and 2) according to the principles specified in Sections 5, 6 and 8.

The following are the major kinds of standard oceanographic and marine meteorological data recorded in connection with oceanographic observations:

4.1.1 Values of air temperature, ocean surface temperature, atmospheric pressure, humidity, speed and direction of wind, precipitation, and visual observations of cloud cover and weather, visibility, sea ice and other atmospheric phenomena (see Section 6.4.3).

4.1.2 Visual and instrumental in situ observations of waves, sea and swell (scale numbers, and/or estimated directions, heights and periods), and data presentation including reduced statistics or spectral parameters.

4.1.3 Colour and transparency using standard secchi discs, and standard colour scales; (see 4.2.3).

4.1.4 Soundings either on plotting sheets, in tabulation, or computer compatible format.

4.1.5 Values of temperature, salinity, (or its measures) and chemical properties from water bottle samples at surface and at depth, and data from continuous records of physical properties such as bathythermograms (BT and XBT) and salinity-temperature-depth (STD/CTD) records.

4.1.6 Reduced and quality controlled subsurface current measurements.

4.1.7 Mean monthly and annual sea levels from recording gauges or tide-staffs and reduced data from offshore and oceanic tide and sea level recording instruments.

4.1.8 Values of primary production, plant pigments, zooplankton biomass and micro-nekton biomass. The methods used in obtaining these and any other biological data exchanged should be described in detail.

(The Working Group felt that further expert advice should be sought in drafting the contents of this paragraph).

4.1.9 Underway marine gravity and geomagnetic field measurements.

(The Working Group felt that further expert advice from geologists should be sought in identifying standard geological data types)

4.2 Non-standard, experimental and other special observations

In general, unreduced (optical, electrical, and automatic recorded) data for the sea surface or at fixed depths; for example, unreduced recordings produced by instrumented buoys, aircraft, or satellites.

These cover all observations and measurements made by devices and instruments of experimental types or in accordance with experimental procedures; observations and measurements of a unique nature made for specific research projects and those special observations which are either very voluminous or require further elaborate analytical techniques for use or exchange.

Data resulting from these observations or measurements are generally to be retained by originating countries and exchanged only upon request. Originating countries are encouraged to report to World Data Centres and/or other permanent centres (see Section 2) information on the availability and sources of these data (see Section 6).

It is impractical to provide specifications for such kinds of observations and resulting data. When standards for such data are prepared by international groups, they will be appended to or included as future revisions to this Guide. The following list serves only to exemplify some of these types of data: (note the following sections have the same sub-paragraph numbers as the sections on standard data in 4.1).

4.2.1 Specialised meteorological data recorded in connection with oceanographic observations, such as solar radiation, gradient values of wind velocity, etc. (See also paragraph 6.4.3 below).

4.2.2 Experimental measurements of waves, swell, orbital velocity, wave slopes, breaking waves, and techniques such as radar, laser, and remote sensing of wave parameters.

4.2.3 Instrumented optical measurements of water properties other than those mentioned in 4.1.3.

4.2.4 Bottom photographs, topographic profiles, interim bathymetric charts, side-scan sonar records, multi-beam bathymetric sonar, and sonar from deep-towed vehicles or submersibles.

4.2.5 Results of chemical analyses of trace elements, biochemical analyses, under-way continuous chemical records, vertical continuous profiling, and data from undulating recorders and results from pollution studies.

4.2.6 Unreduced continuous recordings of current measurements, doppler and sonar scattering current data, boundary layer velocity data, and continuous profiling or 3-D current velocity data.

4.2.7 Remote sensed satellite altimetry and derived sea level data.

4.2.8 Biological data such as measures of abundance of marine organisms, collections for taxonomic and ecological studies, surface observations of marine life, biological echo traces, underwater sounds and bioluminescence. (Further expert advice to be sought from biologists).

4.2.9 Heat flow, seismic refraction and reflection observations etc., well log and drill-hole profiles. (Further expert advice to be sought from geologists).

4.2.10 Radioactivity in water (radionuclides).